BUILDING ENERGY SIMULATION USER NEWS

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For Users of EnergyPlus, DOE-2, BLAST, SPARK, Genopt and their Derivatives

What's New ?

PC Version of DOE-2.1E from ESTSC .....

DOE-2.1E (version 103) for Windows is expected to be available from DOE's Energy Science and Technology Software Center (ESTSC) in January 2000. Previously, ESTSC licensed only UNIX and VAX versions. This version of DOE-2 incorporates some bug fixes as well as several new features, including Cooled Beam HVAC system and polygon input for exterior, interior and underground walls, floors and ceilings. Like previous DOE-2.1E products from ESTSC, this version accepts textual input but does not have a graphical user interface. A corresponding UNIX version will also be available. For prices and ordering information, phone ESTSC at (423) 576-2606, or send email to ESTSC@ADONIS.OSTI.GOV.

EnergyPlus: First Beta Version .....

The first of several planned beta test versions of EnergyPlus is now available. If you want to test a Windows version of EnergyPlus, DOE's new-generation whole-building program that not only combines the best features of BLAST and DOE-2 but also adds many new capabilities, go to

http://SimulationResearch.lbl.gov > EnergyPlus

EnergyPlus Survey .....

If you haven't already filled out our user survey, please do so before the end of the month. For users of the DOE-2, BLAST and ENERGY-10 programs, we need to know your "wish list" for EnergyPlus. Go to

http://SimulationResearch.lbl.gov > User Survey

Building Design Advisor - Beta 3 Release .....

The Beta 3 release of version 2.0 of the Building Design Advisor (BDA 2.0b3), is available at

http://kmp.lbl.gov/BDA

This version of BDA has links to DOE-2.1E and supports the specification of overhangs, vertical fins and external obstructions.

Continued on p. 22

What's Inside ?

The *Building Energy Simulation User News* is published quarterly by the Simulation Research Group at Lawrence Berkeley National Laboratory with cooperation from the Building Systems Laboratory at the University of Illinois. Direct comments or submissions to Kathy Ellington, MS: 90-3147, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, or email KLEllington@lbl.gov or fax us at (510) 486-4089. Direct BLAST-related inquiries to the Building Systems Laboratory, email support@blast.bso.uiuc.edu or phone (217) 333-3977 12/99 2000

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UMIDUS: A PC Program for the Prediction of Heat and Moisture Transfer in Porous Building Elements[1]

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ABSTRACT

The *UMIDUS* program models coupled heat and moisture transfer within porous media in order to analyze the hygrothermal performance of building elements when subjected to any kind of climate conditions. Both diffusion and capillary regimes are taken into account; that is, the transfer of water in the vapor and liquid phases through the material is analyzed. The model predicts moisture and temperature profiles within multi-layer walls and low-slope roofs for any time step and calculates heat and mass transfer. *UMIDUS* was built in an OOP language to be a fast, accurate and easy-to-use program.

INTRODUCTION

The calculation of energy consumption in buildings by simulation software normally assumes that heat is transferred through building envelopes by pure conduction. However, most building materials are porous, and contain air and water in different phases. Walls are subject to thermal and moisture gradients, and the transfer of heat and mass occurs simultaneously and are interdependent.

Several investigators have developed models for the study of heat and moisture transport in buildings.

- Cunningham (1988) developed a mathematical model for hygroscopic materials in flat structures that uses an electrical analogy with resistances for the vapor flow and an exponential approximation function with constant mass transport coefficients.
- Keresteciogluand Gu (1989) investigated the phenomenon using evaporation-condensation theory in the pendular state (unsaturated liquid flow stage). The application of this theory is limited to low moisture content.
- Burch and Thomas (1991) developed a computational model, *MOIST*, using the finite-difference method to estimate the heat and mass transfer through composite walls under non-isothermal conditions. The thermal conductivity is normally considered constant and the latent heat due to phase change within the wall was neglected; this program is also limited to low moisture content.
- Liesen (1994) used evaporation-condensation theory and a response factor method to develop and implement a model of heat and mass transfer in the Integrated Building Loads Analysis and System Thermodynamics (IBLAST) program. To use this method, hygrothermal property variations were neglected. There is no liquid transfer. This program is restricted to very low moisture content but has the advantage of short calculation time.

UMIDUS was developed to model coupled heat and moisture transfer within porous building elements avoiding limitations such as low moisture content, high computer run time and low accuracy. Both diffusion and capillary regimes are taken into account; that is, the transfer of water in the vapor and liquid phases through the material can be analyzed for any kind of climate. The model predicts moisture and temperature profiles within multi-layer walls or low-slope roofs for any time step and calculates heat and mass transfer. Input files containing hourly data provide information on the conditions at the interior and exterior of the wall. A library of material properties is also available. The orientation and tilt of the wall are considered and convection heat transfer coefficients at the exterior of the wall are calculated hourly from wind velocity data.

UMIDUS was built in *C^{++}Builder,* an OOP language, to be a fast and accurate easy-to-use program. The program runs in the Windows 95, 98 and NT operating systems. The user interface consists of a series of windows in which the user can enter the relevant input data and review the results. The user can move among other applications when the *UMIDUS* simulations are running and several *UMIDUS* projects can be open and running at the same time. *UMIDUS* projects with all their input information and results may be saved and reopened.

UMIDUS MODELS

MATHEMATICAL FORMULATION

The governing partial differential equations are given by eqns. (1) and (2). They were derived from conservation of mass and energy flow in an elemental volume of porous material.

[1] Proc. IBPSA, *Building Simulation '99,* September 13-15, 1999, Kyoto, Japan.

Energy conservation equation

$$\rho_0 c_m(T,\theta)\frac{\partial T}{\partial t} = \frac{\partial}{\partial x}(\lambda(T,\theta)\frac{\partial T}{\partial x}) - L(T)\frac{\partial}{\partial x}(j_V) \quad (1)$$

Mass conservation equation

$$\frac{\partial \theta}{\partial t} = -\frac{\partial}{\partial x}\left(\frac{j}{\rho_l}\right) \quad (2)$$

Equation (1) differs from Fourier's equation for transient heat flow by an added convective transport term (due to moisture diffusion associated with evaporation and condensation of water in the pores of the medium) and by a dependence on the moisture content (so that it is coupled to eqn. (2)). The driving forces for convective transport are temperature and moisture gradients. The vapor flow and total flow (vapor plus liquid) are expressed in terms of transport coefficients, D, associated with the thermal and moisture gradients. According to Philip and DeVries (1957), the equations are:

For vapor flow

$$\frac{j_v}{\rho_l} = -D_{Tv}(T,\theta)\frac{\partial T}{\partial x} - D_{\theta v}(T,\theta)\frac{\partial \theta}{\partial x} \quad (3)$$

For total (vapor plus liquid) flow

$$\frac{j}{\rho_l} = -D_T(T,\theta)\frac{\partial T}{\partial x} - D_\theta(T,\theta)\frac{\partial \theta}{\partial x} \quad (4)$$

Note that the model does not take into account the gravity influence on the transfer of liquid water through roofs; this effect is very small compared to the capillary effect, especially for microporous materials.

Boundary conditions

The outside surface of the wall is exposed to solar radiation, heat and mass convection and phase change. Internally, the wall is exposed to heat and mass convection and phase change.

Submodels

In order to reduce CPU time, and in the case of a lack of data, we derived six submodels from eqn. (1): (5)

$$\rho_0 c_m(T,\theta)\frac{\partial T}{\partial t} = \frac{\partial}{\partial x}(\lambda(T,\theta)\frac{\partial T}{\partial x}) + L(T)\rho_l\frac{\partial}{\partial x}\left(D_{Tv}(T,\theta)\frac{\partial T}{\partial x}\right) + L(T)\rho_l\frac{\partial}{\partial x}\left(D_{\theta v}(T,\theta)\frac{\partial \theta}{\partial x}\right)$$

To simplify writing this equation, we will use V_T and V_θ to designate the second and third right hand terms of eqn. (5) which was derived from eqn. (1). Table 1 schematically describes the submodels derived from the original model.

Submodel	Assumptions	Submodel	Assumptions
0	none (original model)	3	$V_T, V_\theta = 0$
1	$D_\theta, D_T, D_{\theta V}, D_{TV}, c_m$ and λ = constant	4	$V_T, V_\theta = 0$ and λ = constant.
2	$V_\theta = 0$	5	$V_T, V_\theta = 0$ and D_T, D_θ, c_m and λ = constant

Table 1: Schematic description of the submodels derived.

The "apparent" thermal conductivity is related to the "pure" thermal conductivity, l, by the following expression:

$$\lambda_{app}(T,\theta) = \lambda(T,\theta) + L(T)\rho_l D_{Tv}(T,\theta) \quad (6)$$

Submodel 0 is the same as the original model given by eqs. (1-4). Submodel 1 is the same as the original model except that all coefficients are taken to be constant. Submodel 2 omits the source term in eqn. (1), which is associated with a moisture gradient (V_θ). In this case, the equation resulting from eqn. (1) can be written as a function of , l_{app} as:

$$\rho_0 c_m(T,\theta)\frac{\partial T}{\partial t} = \frac{\partial}{\partial x}(\lambda app(T,\theta)\frac{\partial T}{\partial x}) \quad (7)$$

Therefore, Submodel 2 is obtained by combining eqn. (7) and eqs. (2-4). Now, if we disregard the term $L\rho_l D_{TV}$ in eqn. (6), we obtain Submodel 3 by transforming eqn. (7) to:

$$\rho_0 c_m(T,\theta)\frac{\partial T}{\partial t} = \frac{\partial}{\partial x}(\lambda(T,\theta)\frac{\partial T}{\partial x}) \quad (8)$$

Submodel 4 is the same as Submodel 3, except that the pure thermal conductivity, l, is constant. Submodel 5 takes the coefficients D_θ D_T and l to be constant.

UMIDUS submodel 0 is the most precise and, therefore, the most time consuming model. Submodel 5 is the simplest and fastest heat and mass transfer model.

Submodel 4 is equivalent to the model employed in *MOIST* program version 2.

Table 2 compares the mean run time for the different submodels relative to Submodel 0.

The accuracy of each submodel depends basically on the material properties and on the moisture content levels. For hygroscopic walls, for example, sub-model simplifications can result on large errors.

	Submodel					
	0	1	2	3	4	5
Time (%)	100	1	8	6	3	1
		6	8	5	8	0

Table 2: Percent of Submodel 0 run time.

The *UMIDUS* submodels are solved with a finite-volume approach that uses a fully implicit solution scheme with coupling between the conservation equations. Using the Patankar (1980) method with uniform nodal spacing and a generic tridiagonal-matrix solution algorithm (Mendes, 1997), the code solves the temperature and moisture content distributions simultaneously at each time step.

MATHEMATICAL CORRELATIONS

The solar radiation incident on a wall with a given orientation is calculated using the equation given in ASHRAE Handbook A30.3; the solar altitude and azimuth are included in the weather file.

Both the albedo of the ground in front of the outside surface of the wall and the solar absorptivity of the external surface of the wall are user defined. *UMIDUS* includes a feature that allows walls with painted interior and exterior surface to be modeled; the permeance of the paint is entered in units of ng/(Pa-m^2-s).

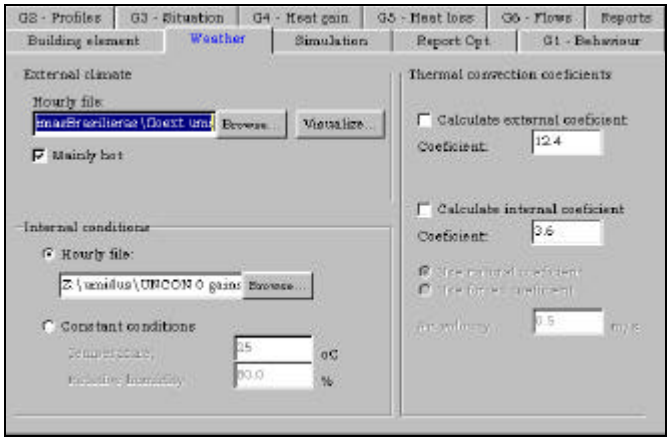

Figure 1: Weather window

The heat and mass transfer coefficients at both the external and internal surfaces may be calculated by *UMIDUS* every hour or entered as fixed values by the user. The external convection heat transfer coefficient is calculated using the wind velocity data from the external weather file. The algorithm used is that proposed by Yazdanian and Klems (1994). The internal convection coefficient can be chosen to be either fixed or calculated using either natural or forced convection according to Alamdari and Hammond (Clarke, 1985). If forced convection coefficient is to be calculated, the user must enter the air velocity, in m/s, on the internal surface of the wall. The mass transfer convection coefficients are calculated by using the Lewis relation. The conditions experienced on either side of the wall are defined in the Weather window as shown in fig. 1.

UMIDUS WEATHER DATA

External Weather -- The conditions on the external side of the element are defined by the external weather file. Weather files for 14 Brazilian cities are available. Each file contains hourly data of dry bulb temperature, relative humidity, direct and diffuse solar radiation, wind speed and direction for a typical year. These files are given the termination UMI, and are in space separated text format. The source of the data for these weather files was the TRY files with solar radiation calculated by DOE-2.1-E. Hourly weather data can be viewed on the *UMIDUS* psychrometrics charts.

Internal Conditions -- The conditions on the internal side of the element may be defined in two ways: (1) An annual internal conditions file may be used to define the hourly condition of temperature and relative humidity. *UMIDUS* includes three internal condition files, with internal gains of respectively 0, 10 and 30 W/m^2, for each of the 14 Brazillian cities. These files were generated using the building simulation program TRNSYS. (2) Alternatively the values of dry bulb temperature and relative humidity at the inside of the element may be fixed as constant values entered by the user.

LAYERS AND THEIR PROPERTIES

Details of the construction of the element to be simulated are entered in the Construction Element window (see fig. 2). Each layer of the element is entered as a row in a table. The element can have a maximum of 10 layers. The user defines the material of each layer from the pull-down menu. There is a choice of 20 materials. The material in the first row is the external layer, the material in the last row is the innermost layer. After choosing the material the user enters how many sections the layer is to be divided into during the simulations. The number of nodes in a layer is equal to the number of sections plus 1. Therefore, if the layer is divided into 4 sections, the layer will have 5 nodes. The thickness of the layer in metres (m) is entered in the next column. The orientation north/south of the wall and the vertical inclination are user defined. The properties data for aerated cellular concrete were obtained from Cunha Neto (1992) and for wood from Siau (1984). Properties for brick and mortar were obtained from Perrin (1985). Laurent and Guerre-Chaley (1995) present the data of thermal conductivity for the same aerated cellular concrete. The properties of the remaining materials were taken from the values given by Burch and Thomas (1991) in version 2 of *MOIST*. However, those materials cannot be simulated using models higher than Submodel 4. The *UMIDUS* material properties files matriz_ are a look up table for thermal conductivity, moisture transport coefficients and sorption isotherms as a function of water content, 0 to 100%. The format of the file is given in fig. 3.

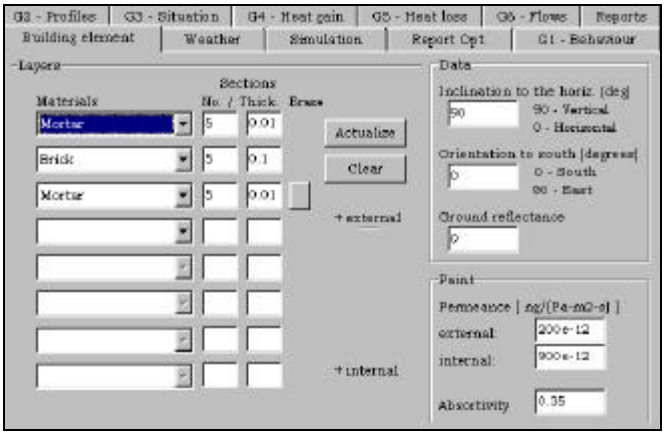

Figure 2: Construction Element Window

Material Name					
Dry density	Dry porosity	Specific Heat Capacity			
Moisture content	Conductivity	D_T	D_θ	D_{TV}	$D_{\theta V}$
0					
"	"	"	"	"	"
1					
Isotherms					
500	0.002				
Relative Humidity	Isothern Function	Derivative of isotherm Function			
0					
"	"	"	"	"	"
1					

Figure 3: Format of Material File

The values of mass transport coefficients (diffusivities) as a function of moisture content are calculated using the coefficients of sorption and permeability given in *MOIST*. *UMIDUS* allows the visualization of material properties (fig. 4); mass transport coefficients, conductivities and sorption isotherms of up to eight materials can be plotted as a function of moisture content.

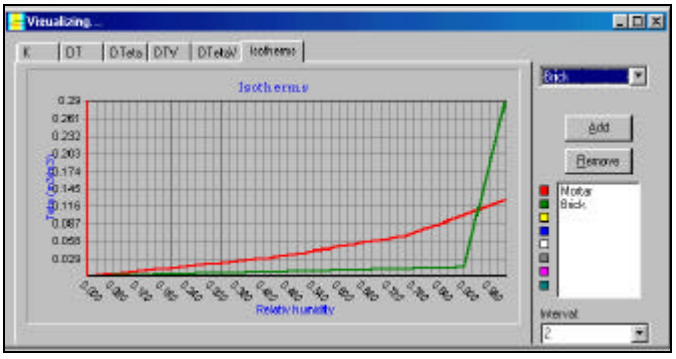

Figure 4: Properties Data Visualization Window

The details of the simulation to be performed (the day, month and hour, when then simulation should start and stop) are entered in the Simulation window, fig. 5. The time step, convergence criteria and the maximum number of iterations permitted are also required.

UMIDUS OUTPUTS

The desired output options are chosen by the user in the Report Options window, fig. 6.

UMIDUS generates profiles of temperature, moisture content and fluxes of heat and mass within and through the wall. The time period for which the results are required are entered by the user.

The results of a *UMIDUS* simulation are presented in the form of six graphs.

- Graph 1 - Behavior
- Graph 2 - Profiles
- Graph 3 - Situation
- Graph 4 - Heat Gain
- Graph 5 - Heat Loss
- Graph 6 - Flux of Heat and Flow of Mass

The Behavior graph, fig. 7, displays the monthly average value of temperature and moisture content at the central node of the element.

The x-axis is divided into the number of nodes in the building element and the temperature and moisture content at each node is displayed. The temperature scale is on the left, the moisture content scale on the right.

The Profiles graph, fig. 8, shows the profiles of temperature and moisture content for a specific hour, day and month which was selected in the report options window of the input section. A list of the chosen hours is displayed on the left of the screen. The user selects the hour to be displayed, by highlighting a date from the list on the left of the window.

The Situation graph, fig. 9, displays the temperature and moisture content at the external and internal faces of the building element and at the central node.

The Heat Gain and Heat Loss graphs, figs. 10 and 11, show the monthly flux of heat through the building element from the outside to the inside (positive heat flow) and the monthly flow of heat through the building element from the inside to the outside (negative heat flow). The percentages of heat gain or loss due to latent heat are also presented.

The Flux of Heat and Flow of Mass graph, fig. 12, shows the flux of sensible and latent heat, and flow of mass for the dates chosen by the user in the reports options window.

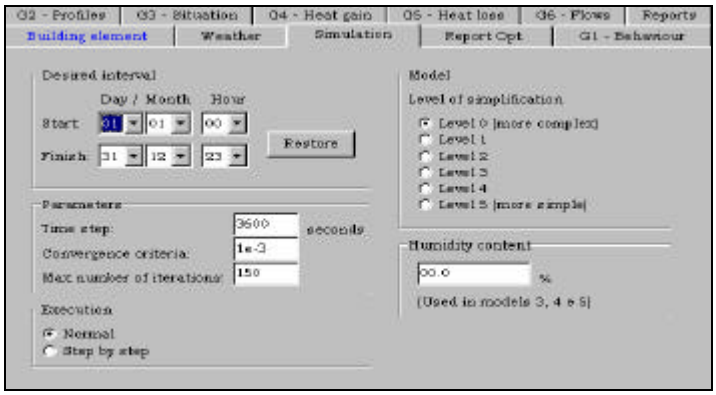

Figure 5: Simulation Window

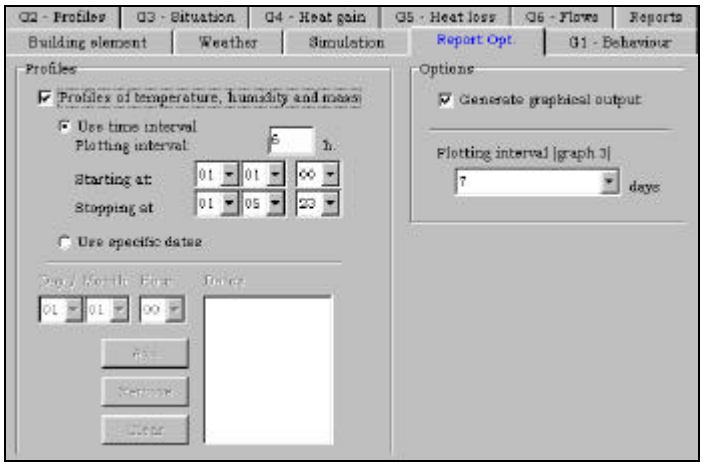

Figure 6: Report Options Window

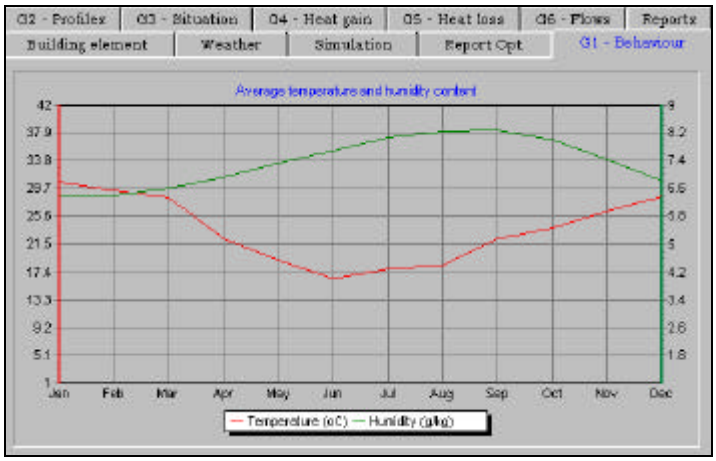

Figure 7: Output Graph 1: Behavior

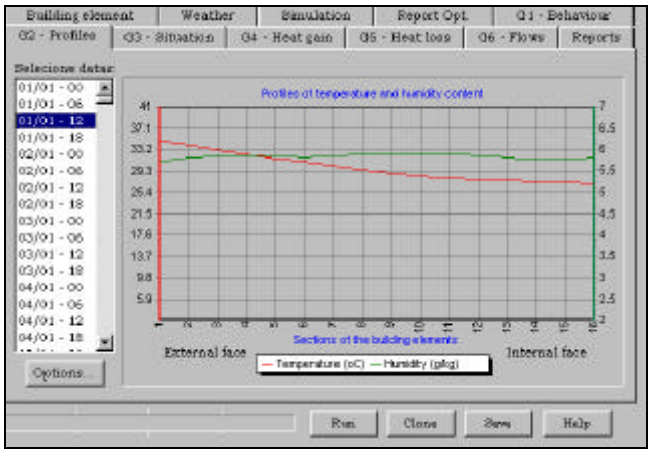

Figure 8: Output Graph 2: Profiles

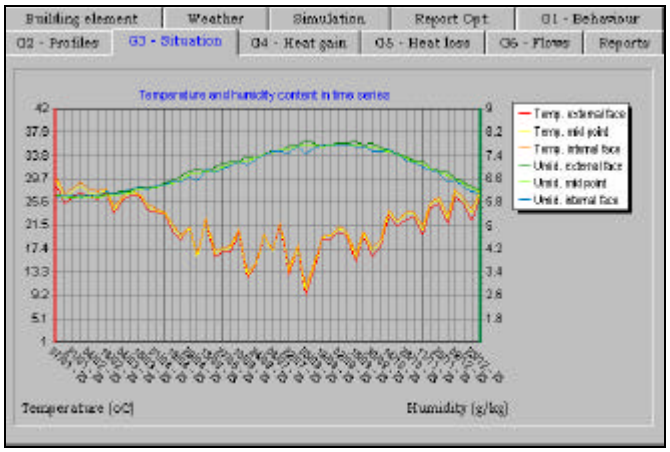

Figure 9: Output Graph 3: Situation

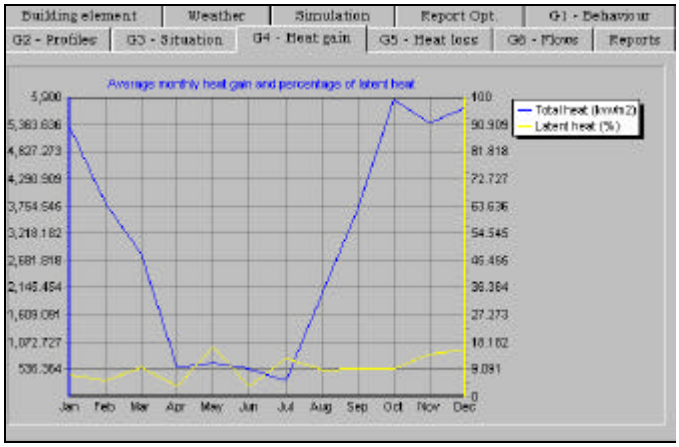

Figure 10: Output Graph 4: Heat Gain

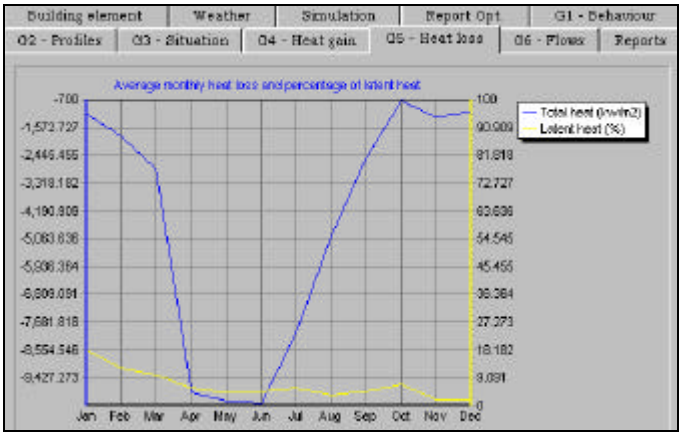

Figure 11: Output Graph 5: Heat Loss

CONCLUSIONS

The models presented here for *UMIDUS* allow calculation of 1-D sensible and latent heat transfer through building elements. Higher accuracy in the heat transfer calculation and the associ-ated thermal loads calculation is achieved by allowing the basic thermal properties of the wall material to depend on moisture content.

The next step of our work with *UMIDUS* is to implement calculation routines, first developed by Mendes (1997) in his Ph.D. thesis, that allow evaluation of all heat and mass transport coefficients from basic data such as pore size distribution, sorption isotherm and dry-basis thermal conductivity. In conclusion, *UMIDUS* is user friendly software which can be used for studying hygrothermal behaviors of walls, helping architects, air-conditioners designers and building material consultants.

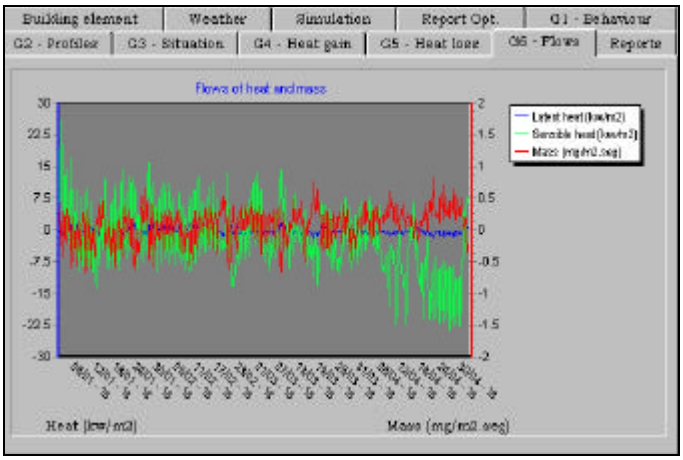

Figure 12: Output Graph 6: Flux of Heat and Flow of Mass

ACKNOWLEDGEMENTS

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NOMENCLATURE

c	specific heat [J/kg-K]	L	heat of vaporization [J/kg]
D_{Tv}	vapor phase transport coefficient associated with a temperature gradient [m^2/s-K]	T	temperature [°C]
$D_{\theta v}$	vapor phase transport coefficient associated with a moisture content gradient [m^2/s]	t	time [s]
D_T	mass (liquid plus vapor) transport coefficient associated with a temperature gradient [m^2/s-K]	x	distance into wall or roof [m]
D_θ	mass transport coefficient associated with a moisture content gradient [m^2/s]	λ	thermal conductivity [W/m-K]
j_l	liquid flow [kg/m^2-s]	θ	moisture volumetric content [m^3 of water / m^3 of porous material]
j_v	vapor flow [kg/m^2-s]	ρ	mass density [kg/m^3]

Subscripts

ext	exterior air	v	vapor
int	interior air	l	liquid
m	mean		

For technical questions and program availability please email Prof. Dr. Nathan Mendes at nmendes@rla01.pucpr.br

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- HVAC Engineer with minimum 5 years experience.

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Send resume in confidence to: Dianne Griffiths, Senior Engineer

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VisualSPARK

Available for Beta Testing

http://SimulationResearch.lbl.gov > SPARK

VisualSPARK allows you to build models of complex physical processes by connecting calculation objects. It is aimed at simulation of innovative and/or complex building systems that are beyond the scope of programs like DOE-2 and BLAST.

The main elements of VisualSPARK are a *user interface*, *a network specification language*, an *HVAC toolkit* containing calculation modules for building components, a *solver* for solving the set of simultaneous algebraic and differential equations that correspond to the physical problem being simulated, a *results display processor* for graphically plotting results and an *interactive graphical editor* (not available in the initial beta release of VisualSPARK). With the network specification language or the graphical editor you link the calculation objects into networks that represent a building's envelope and/or HVAC systems.

The UNIX version of VisualSPARK runs under the SunOS, Solaris, Linux and HPUNIX operating systems. The PC version of VisualSPARK runs under the Windows 95, 98 and NT operating systems. Both versions require a minimum of 30MB of disk space.

There is no charge for the beta version of VisualSPARK; however, a signed beta test license agreement must have been received by the Simulation Research Group at Lawrence Berkeley National Laboratory prior to testing. The agreement and all the instructions may be downloaded from the web address listed above. After the agreement is received, you will be emailed a password. If you would like to get an idea of what SPARK does before testing VisualSPARK, you can review the SPARK User's Manual, which can be downloaded from http://SimulationResearch.lbl.gov > SPARK > SPARK User's Manual.

VisualSPARK was developed by the LBNL Simulation Research Group and Ayres Sowell Associates, with support from the U.S. Department of Energy.

Meetings, Conferences, Symposia

ASHRAE Winter Meeting

To be held
February 5-9, 2000 in Dallas, TX
Contact: jyoung@ashrae.org
ASHRAE Meetings Section
1791 Tullie Circle NE
Atlanta, GA 30329
Tel: 404.636.8400 -- Fax: 321.5478
Net: www.ashrae.org

S S S S S

12th Symposium on Improving Building Systems in Hot and Humid Climates

To be held
May 14-17, 2000 in San Antonio, TX
Contact: drosen@esl.tamu.edu
Dawna Rosenkranz (Rm 053 WERC)
Energy System Laboratory
Texas A&M University
College Station, Texas 77843-3581
Tel: 409.847.8950 -- Fax: 847.8687

S S S S S

ASHRAE Annual Meeting

To be held
June 24-28 in Minneapolis, MN
Contact: jyoung@ashrae.org
ASHRAE Meetings Section
1791 Tullie Circle NE
Atlanta, GA 30329
Tel: 404.636.8400 -- Fax: 321.5478
Net: www.ashrae.org

S S S S S

Healthy Buildings 2000

To be held
August 6-10, 2000 in Espoo, Finland
Contact: info@sisailmayhdistys.fi
Ms. Leila Sarajärvi
P.O. Box 25
FI-02131 ESPOO
Finland
Tel: +358.9.4355.5612 / Fax: x5655
Net: www.hb2000.org

DOE-2 Directory of Program Related Software and Services[1]

ESTSC Versions of DOE-2

Program Name	Operating System	Description	
DOE-2.1E From the Energy Science and Technology Software Center (ESTSC)	Windows UNIX SUN DEC-VAX	Source code, executable code and complete current documentation for: DOE-2.1E/Version 103 for Windows and SUN UNIX DOE-2.1E DEC-VAX	For a complete listing of the software available from ESTSC, order their "Software Listing" catalog, ESTSC-2. [See *User News* Vol. 16, No. 3, p. 21]

Commercial Versions of DOE-2

Program Name	Operating System	Description
ADM-DOE-2 Based on J.J. Hirsch DOE-2.1E	DOS Windows 95	ADM-DOE-2 (DOE-2.1E) is compiled for use on 386/486 PCs with a math co-processor and 4MB of RAM. The package contains everything needed to run the program: program files, utilities, sample input files, and weather files. More than 300 weather files are available (TMY, TRY, WYEC, CTZ formats) for the U.S. and Canada. [See *User News* Vol. 7, No. 2, p. 6]
Compare-IT Based on J.J. Hirsch DOE-2.1E	Windows (98, 95, NT)	Compare-IT allows DOE-2 professionals to add value to their projects by giving clients "what-if" scenarios using DOE-2. The interface is designed for novice energy analysts and the GUI can be customized for each client's particular interests. A tabbed main window is configured based on the user's DOE-2 macro organization. All labels, drop-down list boxes, tool-tips, error checking, and help files are created dynamically from a "Compare-IT-ized" DOE-2 input file. Output are tables and powerful graphs of annual costs, annual energy and end-use and hourly end-use values. [See *User News* Vol. 19, No. 1]
DOE-PLUS Based on J.J. Hirsch DOE-2.1E Demo: www.halcyon.com/byrne	DOS Windows (3.1, 95, NT)	Complete support for all DOE-2 commands. Imports BDL files created with a text editor or other program. Interactive error checking. 3-D view of building can be rotated and zoomed. Windows, walls, etc., identified by DOE-2 U-name and allow component editing. User-defined libraries of schedules, HVAC systems, plant equipment, building components, etc. Exports results to spreadsheets and database programs. Graphical display of schedules. Utility programs included: Prep, Demand Analyzer, weather processor. Over 500 worldwide weather files. [See *User News* Vol. 13, No. 2, p. 54, Vol. 16, No. 1, p. 28-32]
EnergyPro Based on ESTSC DOE-2.1E Demo: www.energysoft.com	Windows (95, NT)	Performs nonresidential load calculations for HVAC equipment sizing. Produces typeset quality reports/forms. Electronically exports forms to AutoCad for inclusion on blueprints. On-line help. 344 weather files for the U.S. and Canada. For California Users: Performs Title 24 compliance calculations, includes state-certified HVAC and DHW Equipment directories, Title 24 tailored lighting calculations. [See *User News* Vol. 18, Nos. 2, 4]
EZDOE Based on J.J. Hirsch DOE-2.1D Demo: www.elitesoft.com	DOS	Provides full screen, fill-in-the-blank data entry, dynamic error checking, context-sensitive help, mouse support, graphic reports, a 750-page user manual, and extensive weather data. EZDOE integrates the full calculation modules of DOE-2 into a powerful, full implementation of DOE-2 on DOS-based 386 and higher computers. On-line help. Includes some weather files. *[See User News Vol. 14, No. 2, p. 10 and No. 4, p. 8-14]*
FTI/DOE Based on ESTSC DOE-2.1E No demo, 30-day trial period	DOS Windows (3.x, 95, NT) AIX, ULTRIX, VMS, Linux, NeXTStep,	FTI/DOE is 100% compatible with LBNL version. Highly optimized and extremely reliable. Version 3.1 will include a graphical user interface and will provide full command functionality and access to all reporting features of the original. Interface is Java-based and will be available for any system supporting Java. Source code versions will compile with most F77-compliant compilers. On-line help: Yes for Version 3.x, No for Version 2.x. 344 weather files for the U.S. and Canada. *[See User News Vol. 12, No. 4, p. 16]*
PRC-DOE-2 Based on J.J. Hirsch DOE-2.1E No demo	DOS Windows (95, NT)	This text-based version of DOE-2 is fast, reliable, and very up to date. Documentation includes 2.1E Supplement, 2.1E BDL Summary; original Reference Manual. Extensive information on new features is included on the disk as well, including information on new system types, new commands, new options, etc., added to later versions of 2.1E.
VisualDOE 3.0 Based on J.J. Hirsch DOE-2.1E, Demo: www.eley.com	DOS Windows (3.1, 95, NT)	Dramatically faster construction of building geometry using pre-defined blocks and/or drawing interface. Import zone shapes from CADD file (dxf format). Point-and-click to define zone properties and HVAC systems. Define up to 20 design alternatives in each project file. View rotatable 3-D image of model. Create custom hourly output reports and customized graphs. Edit and expand library of constructions, schedules, equipment, and utility rates. Add custom performance curves. Network version allows sharing of libraries. On-line help. 400+ weather files for the U.S., 12+ weather files for Canada, plus selected locations around the world. *[See User News Vol. 15, No. 2, p. 10; Vol. 16, No. 4, p. 9-16; Vol. 17, No. 4]*

[1] We list third-party DOE-2-related products and services for the convenience of program users, with the understanding that the Simulation Research Group does not have the resources to check the DOE-2 program adaptations and utilities for accuracy or reliability.

DOE-2 Directory of Program Related Software and Services

ESTSC Versions of DOE-2

Input Output	Support	Program Price	Vendor Information
	Limited "operational" support, which includes telephone assistance concerning installation, media or platform questions.	Windows version: call ESTSC SUN version: Govt/Educ $400 U.S., Mexico, Canada $1305 Other Foreign $2000 VAX version: Govt/Educ $500 U.S., Mexico, Canada $1835 Other Foreign $2716	**Energy Science & Technology Software Center** P.O. Box 1020 Oak Ridge, TN 37831-1020 Ph: 423-576-2606 / Fx: 423-576-2865 ESTSC@ADONIS.OSTI.GOV www.doe.gov/html/osti

Commercial Versions of DOE-2

Input Output	Support	Program Price	Vendor Information
No information given No information given	None	$395 + $15/SH including one set weather data (your choice) and documentation	**ADM-DOE- 2** **(Richard Burkhart)** ADM Associates adm_asc@ns.net 3239 Ramos Circle Sacramento, CA 95827-2501 Ph: 916-363-8383 / Fx: 916-363-1788
Customizable windows GUI dynamically built based on DOE-2 macros. Tables and graphs exportable to MS Excel 97. Custom reports dynamically generated in Word 97.	Support price is negotiable; online help included with the program.	$500 consultant $2000 client Documentation available	**Compare-IT** **(Ed Erickson)** RLW Analytics, Inc. 1055 Broadway, Suite G Sonoma, CA 95476 Ph: 707-939-8823 / Fx: 707-939-9218 Info@rlw.com or www.rlw.com
Interactive, graphical, fill-in-the-blanks Customizable tables and graphics	Unlimited, except for DOE-2 modeling advice. On-line help.	$895 with DOE-2 and doc $495 without DOE-2 Source code not available.	**DOE-Plus** **(Steve Byrne)** Item Systems 321 High School Road NE #344 Bainbridge Island, WA 98110 Ph: 206-855-9540 / Fx: 206-855-9541 byrne @ item.com
Graphical Graphs, forms	Unlimited support	DOE-2 Module: Non-residential $ 700[1,2] Residential $ 250[1,2] Program Interface $ 195[3] [1] price reflects cash discount [2] includes documentation [3] required	**EnergyPro** **(Demian Vonderkulen)** Gabel Dodd/EnergySoft LLC 100 Galli Drive #1 Novato, CA 94949-5657 Ph: 415-883-5900 / Fx: 415-883-5970 demian@energysoft.com
Fill-in-the-blanks Standard DOE reports plus some custom graphic reports	Unlimited phone support	$1295 w/documentation Source code not available.	**EZDOE** **(Bill Smith)** Elite Software P.O. Box 1194 Bryan, TX 77806 Ph: 409-846-2340 / Fx: 409-846-4367 bsmith @ elitesoft.com
Version 2.x: text based Version 3.x: graphical All standard DOE-2 reports Run time and status graphics	Free support for 90 days from date of purchase. After 90 days, support is: $35 email per incident $55 hour per incident $125 per hour for engineering advice. Bugs reports free.	$ 995.99 US w/documentation $1066 Int'l w/documentation $4999.99 source code	**FTI/DOE2** **(Scott A. Henderson)** Finite Technologies Inc. 3763 Image Drive Anchorage, Alaska 99504 Ph: 907-333-8937 / Fx: 907-333-4482 info @ finite-tech.com
Standard text-based	Unlimited support.	$ 495 w/documentation Source code not available.	**PRC-DOE-2** **(Paul Reeves)** Partnership for Resource Conservation 140 South 34th Street Boulder, CO 80303 Ph: 303-499-8611 / Fx: 303-554-1370 Paul.Reeves@DOE2.com
Graphical Graphical	90 days free phone and email support. Support is $195 per year after first 90 days	Version 2.6 is $495 w/documentation Call for Version 3.0 pricing Source code not available.	**VisualDOE 3.0** **(Charles Eley or Erik Kolderup)** Charles Eley Associates 142 Minna Street San Francisco, CA 94105 Ph: 415-957-1977 / Fx: 415-957-1381 support@eley.com www.eley.com

Continued on next page

DOE-2 Directory of Program Related Software and Services (continued)

Pre- and Post-Processors for DOE-2

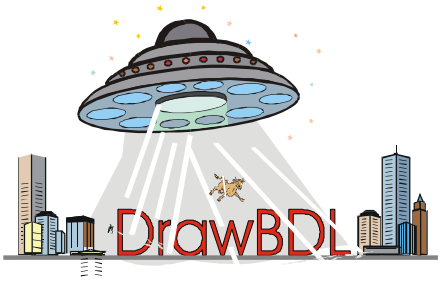
Program Name	Description
DrawBDL	**DrawBDL,** Version 2.1, is a graphic debugging and drawing tool for DOE-2 building geometry. DrawBDL reads your BDL input and makes a rotateable 3-D drawing of your building with walls, windows, and building shades shown in different colors for easy identification. *[See User News, Vol. 14, No. 1, p. 5-7, Vol. 14, No. 4, p. 16-17, and Vol. 16, No. 1, p.37]*
Visualize-IT (Visual Data Analysis Tools)	The ***Energy Information Tool*** is used to review and understand metered or DOE-2.1E hourly output data. It provides the ability to see all 8760 (or 35040) data points for a year's worth of data. Use *Energy/Print* to get an overview of the data and then apply a variety of tools (load shapes, load duration curves, etc.). The ***Calibration Tool*** compares DOE-2.1E hourly output data to total load and/or end-use metered data. Options include monthly demand and load 2D graphs, maximum and seasonal load shapes, average load profiles, end use residuals, monthly average week and weekend days, and dynamic comparison load shapes. Both programs requires a 486 or higher computer and SVGA graphics capabilities. *[See User News Vol. 17, No. 2, p. 2-6]*
PRC-TOOLS: **PRC-Grab** **PRC-Hour** **PRC-Peak**	***PRC-Tools*** aid in extracting, analyzing, and formatting DOE-2 output. ***PRC-Grab*** automates the process of extracting any number of answers from DOE-2 standard output files. ***PRC-Hour*** and ***PRC-Peak*** format the hourly output and create Peak-Day and Average-Day load shapes for any number of periods and for any combination of hourly values.

Special Versions of DOE-2

Program Name	Description
DesiCalc No demo	DesiCalc, from the Gas Research Institute, screens desiccant cooling applications. It estimates annual or monthly energy loads, using hour-by-hour simulations, and costs for 11 typical commercial buildings in 236 geographical locations in the United States. The tool uses electrical equipment from a library of five typical systems and compares the performance of any of the systems with an alternative configuration, the chosen electric system supplemented with a desiccant dehumidifier. Includes the latest TMY2 meteorological database
Energy Gauge USA (Residential DOE-2)	*Energy Gauge USA* allows the simple calculation and rating of residential building energy use in the United States. The simulation calculates a six-zone model of the residence (conditioned zone, attic, crawlspace, basement, garage and sunspace) with the various buffered spaces linked to the interior as appropriate. TMY weather data for the program are available for 239 locations around the U.S.
Home Energy Saver (Residential DOE-2) Free, interactive, Web-based program	The *Home Energy Saver* (HES) is designed to help consumers identify the best ways to save energy in their homes, and find the resources to make the savings happen. The HES calculates heating and cooling consumption using DOE-2.1E. The program performs a full annual simulation for a typical weather year (involving 8760 hourly calculations) from 239 locations around the United States in about 10-20 seconds.
Perform-95	Created for the State of California Energy Commission's, Title 24 energy code. Perform-95 is an interface shell with DOE-2 as the engine. Standard text-based input. Output is only California Title 24 compliant. Technical support available for $100/year from Gabel-Dodd Energy Soft LLC, 100 Galli Drive #1, Novato, CA 94960. Call 415-883-5900 for details.
RESFEN-3.1 Website: http://windows.lbl.gov/software/resfen	RESFEN calculates the energy and cost implications of a building's windows compared to insulated walls. The relative energy and cost impacts of two different windows can also be compared against each other. RESFEN calculates the heating and cooling energy use and associated costs as well as the peak heating and cooling demand for specific window products. Users define a problem by specifying the house type (single story or two story), geographic location, orientation, electricity and gas cost, and building configuration details (such as wall type, floor type, and HVAC systems). Window options are defined by specifying the window's size, shading, and thermal properties: U-factor, Solar Heat Gain Coefficient, and air leakage rate.

DRAWBDL Version 2.1 with *Expanded* Memory by Joe Huang

The **DRAWBDL** program was recently upgraded to run under the 32-bit Windows environment. **DRAWBDL** 2.1 can display DOE-2 input files of any size. Several users have notified me over the years that they had problems displaying large DOE-2 input files. The reason was that **DRAWBDL** was originally developed under the 16-bit Windows Operating System; this limited the program's ability to display no more than 1200 building surfaces. At the time, I didn't think this would be a problem because DOE-2 itself limits the numbers of spaces, walls, etc. However, many of you have figured out how to expand those DOE-2 limits, so that I have now seen files with thousands of surfaces! The new **DRAWBDL** is limited only by the size of your computer memory; the functionality is unchanged from version 2.02, although, the screen display will look a little different cosmetically.



Joe Huang & Associates
6720 Potrero Avenue
El Cerrito, CA 94530
Ph/Fx: 510-236-9238

For those customers who purchased **DRAWBDL** after September 1998, we will e-mail you a copy of Version 2.1 free of charge. For customers who purchased **DRAWBDL** prior to September 1998, we can send you the new version 2.1 for a cost of $15 via e-mail or $20 via floppy disk.

DOE-2 Directory of Program Related Software and Services

Pre- and Post-Processors for DOE-2

Operating System	Works With This Version of DOE-2	Price	Vendor
Windows 3.1, 95, 98, NT	DOE-2.1E	$125.00 plus shipping	**Joe Huang & Associates** 6720 Potrero Avenue El Cerrito, CA 94530 Ph/Fx: 510-236-9238
Windows 3.1	DOE-2.1E		**RLW Analytics, Inc.** **(Ed Erickson)** 1055 Broadway, G Sonoma, CA 95476 Ph: 707-939-8823 Fx: 707-939-9218 Info@rlw.com / www.rlw.com
Windows 95, 98 NT	DOE-2.1E	$99.00	**Partnership for Resource Conservation** 140 South 34th Street **(Paul Reeves)** Boulder, CO 80303 Ph: 303-499-8611 / Fx: 303-554-1370 Paul.Reeves@DOE2.com

Special Versions of DOE-2

Operating System	Based on this version of DOE-2	Price	Vendor
Windows 3.1, 95, 98, NT	DOE-2.1E	$295 including documentation +8.75% tax in IL +4.5% tax in VA S/H $20	**DesiCalc GRI-98/0127** **(Doug Kosar)** Order from: GRI Fulfillment Center Ph: 773-399-5414 Fx: 630-406-5995
Windows 95, 98, NT	DOE-2.1E	Contact Danny Parker at FSEC for availability.	**Energy Gauge USA** **(Danny Parker)** Florida Solar Energy Center 1679 Clearlake Road Cocoa, FL 32922 Ph: 407-638-1405 /Fx: 407-638-1439
Web-based	DOE-2.1E	free	**Home Energy Saver** WWW interactive program at http://hes.lbl.gov
DOS	DOE-2.1E	$250 including Perform-95 manual. Order #P440-96-0006	**California Energy Commission** Publications MS-13 P.O. Box 944295 Sacramento, CA 94244-2950 Ph: 916-654-5106
Windows 95, 98, NT	DOE-2.1E	free	**RESFEN 3.1** Fax: (510) 486-4089 or mail your request to: Windows & Daylighting Group MS 90-3111 Lawrence Berkeley National Laboratory Berkeley, CA 94720

Optimize your Building Designs with ...

GenOpt®: A Generic Optimization Program

GenOpt 1.0, a multi-parameter optimization program, is available from LBNL. It automatically finds the values of user-selected design parameters that minimize an *objective function*, such as annual energy use calculated by an external simulation program like DOE-2, BLAST, TRACE, SPARK, TRNSYS, etc. GenOpt can be used with any simulation program that has text-based input and output. It also offers an interface for adding custom optimization algorithms to its library.

The Genopt 1.0 program and user's manual may be downloaded free of charge from http://SimulationResearch.lbl.gov > GenOpt.

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blastnews

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The **Building Loads Analysis and System Thermodynamics (BLAST)** system is a comprehensive set of programs for predicting energy consumption and energy system performance and cost in buildings. The BLAST system was developed by the U.S. Army Construction Engineering Research Laboratory (USACERL) under the sponsorship of the Department of the Air Force, Air Force Engineering and Services Center (AFESC), and the Department of the Army, Office of the Chief of Engineers (OCE). After the original release of BLAST in December 1977, the program was extended and improved under the sponsorship of the General Services Administration, Office of Professional Services; BLAST Version 2.0 was released in June 1979. Under the sponsorship of the Department of the Air Force, Aeronautical System Division, and the Department of Energy, Conservation and Solar Energy Office, the program was further extended; BLAST Version 3.0 was completed in September 1980. Since 1983, the BLAST system has been supported and maintained by the Building Systems Laboratory at the University of Illinois at Urbana-Champaign.

BLAST can be used to investigate the energy performance of new or retrofit building design options of almost any type and size. In addition to performing peak load (design day) calculations necessary for mechanical equipment design, BLAST also estimates the annual energy performance of the facility, which is essential for the design of solar and total energy equipment design, BLAST also estimates the annual energy performance of the facility, which is essential for the design of solar and total energy (cogeneration) systems and for determining compliance with design energy budgets. Repeated use of BLAST is inexpensive; it can be used to evaluate, modify, and re-evaluate alternate designs on the basis of annual energy consumption and cost.

The BLAST analysis program contains three major subprograms:

- The Space Load Prediction subprogram computes hourly space loads in a building based on weather data and user inputs detailing the building construction and operation.
- The Air Distribution System Simulation sub-program uses the computed space loads, weather data, and user inputs describing the building air- handling system to calculate hot water, steam, gas, chilled water, and electric demands of the building and air-handling system.
- The Central Plant Simulation subprogram uses weather data, results of the air distribution system simulation, and user inputs describing the central plant to simulate boilers, chillers, on-site power generating equipment and solar energy systems; it computes monthly and annual fuel and electrical power consumption.

Heat Balance Loads Calculator (HBLC)
The BLAST graphical interface (HBLC) is a Windows-based interactive program for producing BLAST input files. HBLC allows the user to visualize the building model as it is developed and modify previously created input files. Within HBLC, each story of the building is represented as a floor plan which may contain several separate zones. Numerous other building details may be investigated and accessed through simple mouse operations. On-line helps provide valuable on-the-spot assistance that will benefit both new and experienced users. HBLC is an excellent tool which will make the process of developing BLAST input files more intuitive and efficient. You can download a demo version of HBLC (for MS Windows) from the BLAST web site (User manual included!).

HBLC/BLAST Training Courses
Experience with the HBLC and the BLAST family of programs has shown that new users can benefit from a session of structured training with the software. Such training helps to define the steps necessary to produce accurate and consistent output from BLAST and its auxiliary programs and gives users a solid foundation from which they can explore the more advanced features of the program with confidence. The Building Systems Laboratory offers such training courses on an as needed basis typically at our offices in Urbana, Illinois and lasting 2 or 3 days depending on the specific needs of the participants. Call the Building Systems Laboratory for additional information on pricing and availability.

WINLCCID 98
LCCID (Life Cycle Cost in Design) has been a standard in the DOD community since its initial release in 1986. LCCID was developed to perform Life Cycle Cost Analyses (LCCA) for the Department of Defense and their contractors, yet it goes far beyond being just a DOD study tool by providing many features of a general purpose life cycle costing tool. With LCCID, it's easy to carry out "what-if" analyses based on variables such as present and future costs and/or maintenance and repair costs. LCCID allows an analysis based on standard DOD procedures and annually updated escalation factors as well as Energy Conservation Investment Program (ECIP) LCCA. You can download a demo version of WINLCCID 98 (for MS Windows) from the BLAST web site http://www.bso.uiuc.edu [see *User News* Vol. 16, No. 4, p. 5]

To order BLAST-related products, contact the Building Systems Laboratory at the address above.

Program Name	Order Number	Price
PC BLAST Package The standard PC BLAST Package includes: BLAST, HBLC, BTEXT, WIFE, CHILLER, Report Writer, Report Writer File Generator, Comfort Report program, Weather File Reporting Program, Control Profile Macros for Lotus or Symphony, and the Design Week Program. The package is on a single CD-ROM and also includes soft copies of the BLAST Manual, 65 technical articles and theses related to BLAST, nearly 400 processed weather files with a browsing engine, and complete source code for BLAST, HBLC, etc. Requires an IBM PC 486/Pentium II or compatible running MS Windows 95/98/NT.	3B486E3-0898	$1500
PC BLAST Package Upgrade from level 295+	4B486E3-0898	$450
WINLCCID 98: executable version for 386/486/Pentium	3LCC3-0898	$295
WINLCCID 98: update from WINLCCID 97	4LCC3-0898	$195

The last four digits of the catalog number indicate the month and year the item was released or published. This will enable you to see if you have the most recent version. All software will be shipped on 3.5" high density floppy disks unless noted otherwise.

INTERNATIONAL DOE-2 RESOURCE CENTERS

The people listed here have agreed to be primary contacts for DOE-2 program users in their respective countries. Each resource center has the latest program documentation, all back issues of the User News, and recent LBNL reports pertaining to DOE-2. Users may make arrangements to photocopy the new material for a nominal cost. We hope to establish centers in other countries; please contact us if you want to establish a center in your area.

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Dr. Sam C. M. HUI or K.P. Cheung, Dept of Architecture, University of Hong Kong, Pokfulam Road, Hong Kong (SAR), CHINA / cmhui@hku.hk or kpcheuna@hku.hk / http://arch.hku.hk/research/BEER/DOE-2/DOE-2.htm Tel: +852 2859-2123 (direct to Sam Hui) / Fax: +852 2559-6484

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Prof. L. J. Grobler, School of Mechanical and Materials Engineering, University of Potchefstroom, Private Bag X6001, Potchefstroom 2520, South Africa, mgiljg@puknet.puk.ac.za / Tel: +27 148 299 1328 / Fax: +27 148 299 1320

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New LBNL Report: ***"Net Energy Performance Measurements on Electrochromic Skylights"*** ***LBNL-42825***

J. H. Klems
Building Technologies Department / Environmental Energy Technologies Division
Lawrence Berkeley National Laboratory / University of California
Berkeley, CA 94720

Abstract
Tests of skylights made from prototype electrochromic glazings were performed in a room-sized calorimetric test facility under ambient outdoor summer conditions in Reno, NV. The test methodology and the resultant measurements of skylight heat flows and temperatures with their diurnal variations are presented. Special test issues relating to the dynamic switchable nature of the glazings are discussed.

Please contact Pat Ross (email PLRoss@lbl.gov or fax 510-486-4089) for a copy of this report; refer to report by title and LBNL number.

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http://www.gard.com/ml/bldg-sim.htm http://www.gard.com/ml/bldg-sim.htm http://www.gard.com/ml/bldg-sim.htm

The BLDG-SIM

Mailing List

BLDG-SIM is a mailing list for users of building energy simulation programs. These programs allow users to estimate the energy use and operating cost of residential, commercial and other types of buildings. This allows engineers, architects and others in the building design trade to compare alternative designs and select the design that is cost justified. They are frequently used during the design process when choosing between alternatives in the components that make up a building including insulation level, heating and cooling distribution systems, furnaces, boilers and air conditioning equipment. The web page for this mailing list is located at

http://www.gard.com/ml/bldg-sim.htm

Examples of building simulation programs include EnergyPlus, DOE-2, Trace-600, HAP, BLAST, SPARK, ESP, SERIRES, TRNSYS, TASE, ENERGY-10, and others.

Since the users of building energy simulation programs are spread across the world, this mailing list is an attempt to foster the development of a community of those users. Experienced and inexperienced users of building energy simulation programs are welcome and are expected to share their questions and insights about these programs.

The BLDG-SIM mailing list has 5-10 messages per week and currently has over 200 members. Since its start in early March, 1999, it has helped people find

- sources of int'l weather files,
- exterior shading algorithms,
- hospital end-use disaggregation,
- atrium chimney effect modeling,
- best user interfaces for DOE-2, etc.

Questions should be emailed to Jason Glazer, manager of the list, at jglazer@gard.com.

http://www.gard.com/ml/bldg-sim.htm http://www.gard.com/ml/bldg-sim.htm http://www.gard.com/ml/bldg-sim.htm

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Index to the *User News*

Volume 1, Number 1 (August 1980) through Volume 20, Number 4 (Winter 1999)

The index lists *User News* volumes, issues and page numbers as follows: title of the article, program version that was current when the article appeared. Volume number, issue number (No. 1 = Spring, No. 2 = Summer, No. 3 = Fall, No. 4 = Winter) and page number.

For example, the entry "Advanced Simulation (2.1C) ... 7:4,4-8" means that the article "Advanced Simulation" was printed when DOE-2.1C was the current version of the program. The article is in Volume 7, Number 4 (Winter), on pages 4 through 8. All back issues are available, free of charge. Fax your request to Kathy Ellington at (510) 486-4089 or email to KLEllington@lbl.gov.

What's New ? (continued from p. 1)

IBPSA Newsletter .....

The newsletter of the International Building Performance Simulation Association may now be downloaded from their web site as a PDF file; go to

www.mae.okstate.edu/ibpsa/newsletter.htm

"Daylighting Calculation in DOE-2" .....

This LBNL report has been placed on the www at

http://eande.lbl.gov/Task21/LBL_11353/TOCpage.html

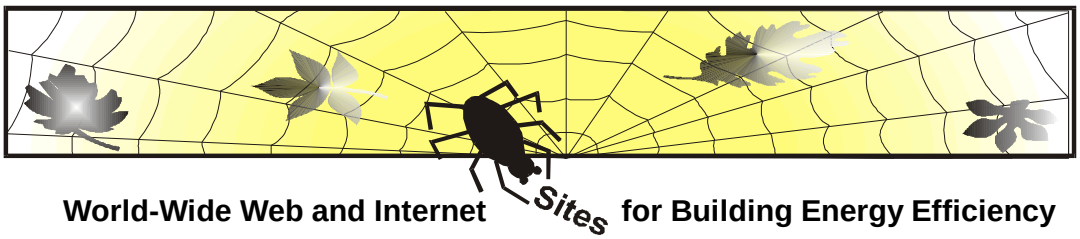
The report is an oldie, but the information is timeless!

Commercial Code Compliance .....

From *Setting the Standard*, newsletter of the U.S. Department of Energy's Building Standards and Guidelines Program, DOE announces release of two new software tools for checking commercial building code compliance with ASHRAE Standard 90-1. COM*Check-EZ 2.0* and COM*check-Plus 1.0* are downloadable from http://www.energycodes.org

Two, Count 'em, TWO new Resource Centers! .....

The newest DOE-2 resource centers are in the Czech Republic and Italy. See p. 15 for details.



World-Wide Web and Internet Sites for Building Energy Efficiency

hes.lbl.gov
The Home Energy Saver (HES) uses DOE-2.1E to perform a full annual simulation for a typical weather year (involving 8760 hourly calculations) in about 10-20 seconds. Users can choose from 239 weather locations around the U.S. Default energy prices for each fuel and state are also available, or a specific price may be input. The HES calculates domestic water heating energy consumption using a detailed model developed at LBNL. Users can see how household size, age of occupants, equipment efficiencies and water inlet temperatures affect bottom-line energy costs. And by simply entering the number and approximate age of their major appliances, users can estimate their energy consumption based on historic sales-weighted efficiency data. A very detailed module estimates energy consumption and savings opportunities for lighting and dozens of miscellaneous gas and electric appliances.

www-esl.tamu.edu
The Energy Systems Laboratory is the research focus for studies of energy conservation and at Texas A&M University.

eande.lbl.gov/CIEE/ciee_homepage.html
The California Institute for Energy Efficiency is an innovative University of California partnership of energy agencies, utilities, building industry, non-profits, and research entities designed to advance energy efficiency science and technology.

www.fbe.unsw.edu.au/units/solarch
(Australia) SOLARCH, the National Solar Architecture Research Unit, is dedicated to developing and sharing information and techniques to improve the energy efficiency and environmental impact of the built environment.

www.crest.org/efficiency/bcap/update.html
Status of State Energy Codes not only provides up-to-the-minute information on changes of state energy codes, but allows you to download code compliance software.

www.montana.com/crbt/
Residential Energy Efficiency Database (REED) is designed as a guide to understanding residential energy efficiency. Each section provides users with a wide range of background information, usable how-to information and detailed illustrations and plans on energy efficient housing.

www.mecheng.asme.org/
A searchable engineering software database provided as a service from the American Society of Mechanical Engineers.

civil.colorado.edu/Research_Groups/Jcem/jcemmain.html
The Joint Center for Energy Management at the University of Colorado conducts research directed at improved energy efficiency and improved mechanical systems for buildings.

DOE-2 Training	DOE-2 courses for beginning and advanced users, phone Marlin Addison at (602) 968-2040, or send email to marlin.addison@doe2.com
DOE-2 Help Desk	Bruce Birdsall - Phone/Fax: (925) 671-6942, M-F 10 a.m. to 3 p.m. PDT Call or fax Bruce Birdsall if you have a DOE-2 problem or question. If you need to fax Bruce, please be sure to phone him first. This is a free service provided by the Simulation Research Group at Lawrence Berkeley National Laboratory.
Newsletter Deadline	The Spring 2000 issue of the *User News* will be sent to the printing plant in the middle of March; please submit any articles by February 15.
Newsletter Subscription	The *User News* is a free, quarterly newsletter. It is also available in PDF format at http://SimulationResearch.lbl.gov > Publications > User News. To subscribe to the newsletter or to obtain back issues, please contact: Kathy Ellington, Simulation Research Group MS: 90-3147, Lawrence Berkeley National Laboratory, Berkeley, CA 94720. Fax: (510) 486-4089 or email KLEllington@lbl.gov

DOE-2.1E Bug Fixes via FTP You can obtain the latest bug fixes to the LBNL/ESTSC version of DOE-2.1E by anonymous ftp. Here's how…
ftp to either gundog@lbl.gov or to 128.3.254.10
login: *type* anonymous
password: *type in your e-mail address*
After logging on, go to directory **pub/21e-mods** ; bug fixes are in files that end with **.mod** . A description of the fixes is in file **VERSIONS.txt** in directory **pub** . Each fix has its own version number, ***nnn*** , which is printed out as DOE-2.1E- *nnn* on the DOE-2.1E banner page and output reports when the program is recompiled with the fix. You may direct questions to Ender Erdem (aeerdem@lbl.gov).

Software Available From Lawrence Berkeley National Laboratory	
Downloads	**Download Site (http://)**
BDA (Building Design Advisor) *Beta 3* (for building decision-makers)	kmp.lbl.gov/BDA
COMIS (multi-zone air flow and contaminant transport model)	www-epb.lbl.gov/comis
EnergyPlus™ (new-generation whole-building energy analysis program, combining best features of BLAST and DOE-2; developed by University of Illinois, CERL, Oklahoma State Univ. and LBNL)	To beta test EnergyPlus for Windows, go to SimulationResearch.lbl.gov > EnergyPlus
GenOpt® (generic optimization program)	SimulationResearch.lbl.gov > GenOpt
RADIANCE (analysis and visualization of lighting in design)	radsite.lbl.gov/radiance/license.html
Desktop Radiance (integrates the Radiance Synthetic Imaging System with AudoCAD Release 14)	kmp.lbl.gov/dt-rad
RESEM (Retrofit Energy Savings Estimation Model) (calculates long-term energy savings directly from actual utility data)	eetd.lbl.gov/btp/resem.htm
SPARK (Simulation Problem Analysis and Research Kernel) (build simulations of innovative building envelope and HVAC systems by connecting component models)	*To beta test VisualSPARK* - for Windows, SUN or UNIX operating systems, go to SimulationResearch.lbl.gov > SPARK
SUPERLITE (calculate illuminance distribution for room geometries)	eetd.lbl.gov/btp/superlite20.html
THERM (model two-dimensional heat-transfer effects in building components where thermal bridges are of concern)	windows.lbl.gov/software/therm/therm.html
WINDOW 4.1 (thermal analysis of window products)	windows.lbl.gov/software/window/window.html

Request by Fax from 510.486.4089	
RESFEN 3.1 (choose the most energy-efficient and cost-effective window for a given residential application)	windows.lbl.gov/software/resfen/resfen.html

Web Based	
Home Energy Saver (quickly compute a home's energy use)	hes.lbl.gov

Purchase	
ADELINE 2.0 (daylighting/lighting performance in complex spaces)	radsite.lbl.gov/adeline/HOME.html

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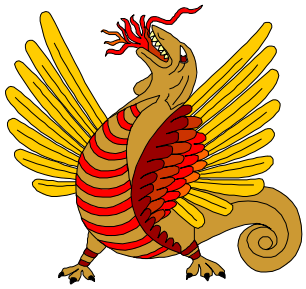

Run for safety, foolish pedestrians!